FACTFILE:
GCSE Technology and Design

OPTION A: ELECTRONIC AND MICROELECTRONIC CONTROL SYSTEMS

Rewarding Learning

2.6 Thyristors

Learning Outcomes

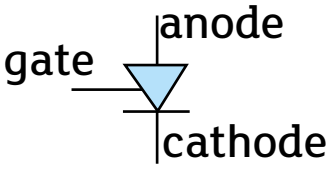
You should be able to:

- explain the use of a thyristor as a latching switch;
- draw and interpret circuit diagrams containing thyristors in switching circuits; and
- explain the operation of circuits containing electronic components including thyristors.

Thyristors

A thyristor is an electronic component that can be used to create a latching circuit. Similar to transistors, they are electronic switches that respond to an input voltage. However, unlike transistors the thyristor will remain on even if the input voltage is removed, allowing electricity to flow until the thyristor is reset. This means that they are very useful in alarm circuits.

How does it operate?



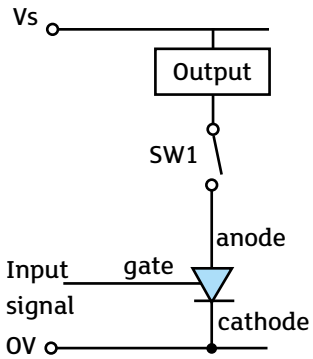
A thyristor is a semi-conductor device. It is triggered to conduct a forward current (in the direction of the diode arrow – from the anode to the cathode) if a small trigger pulse of current is detected at the gate.

After the thyristor starts to conduct, current continues to flow until the voltage between the anode and cathode pins is reduced to zero.

Thyristors have three leads or legs:

- cathode
- anode
- gate

When the gate leg receives a momentary signal the thyristor switches on fully, allowing electricity to flow between the cathode and the anode. The current continues to flow until the thyristor is reset by interrupting the current flow through it.



The circuit on the left will switch the current through the output device on if the switch SW1 is closed and the Input signal voltage (applied to the gate) is detected.

The current will continue to flow through the output device, even if the Input signal voltage is removed.

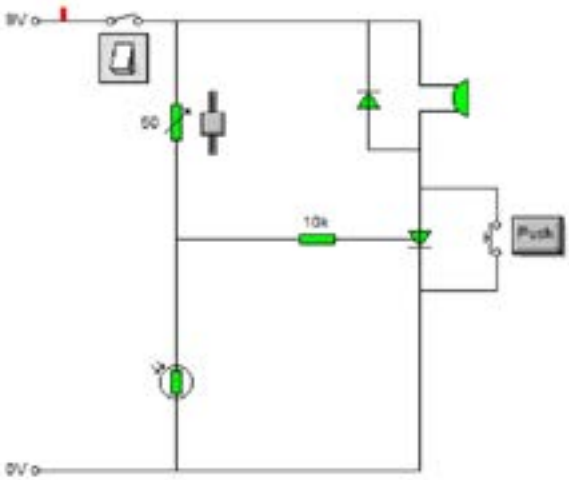
The current through the thyristor can be turned off by opening the switch SW1.

To turn the current back on, the switch needs to be closed and an input signal voltage needs to be applied again.

The 'output' box shown on the circuit diagram represents any output device, e.g. Lamp, buzzer etc.

Possible applications

- A 'smart' steady hand game or other game of skill that sounds a buzzer if the wire is touched and keeps sounding it until a push-to-make switch is pressed.
- Another application would be in alarms; let's look at the circuit below:



When the SPST is closed and in dark conditions the LDR will have a high resistance, this will cause a small voltage at the gate of the thyristor; the thyristor will then be turned on, allowing current to flow from the anode to the cathode. The buzzer will sound.

In light conditions, the LDR resistance will be low, so the voltage at the gate is low; the thyristor will still allow current to flow from the anode to the cathode because it has already been latched on (in dark conditions). The buzzer will still sound.

In order to reset the circuit, the push to make switch in parallel with the thyristor needs to be pressed; this will also stop the buzzer sounding in this example.

The thyristor, once reset will remain off until a small voltage detected again at the gate.

Revision Questions

1. What are the three legs of a thyristor called?

2. What leg requires a small voltage in order to turn the thyristor on?

3. What is the main difference between a thyristor and a transistor?

4. Label the legs of a thyristor: